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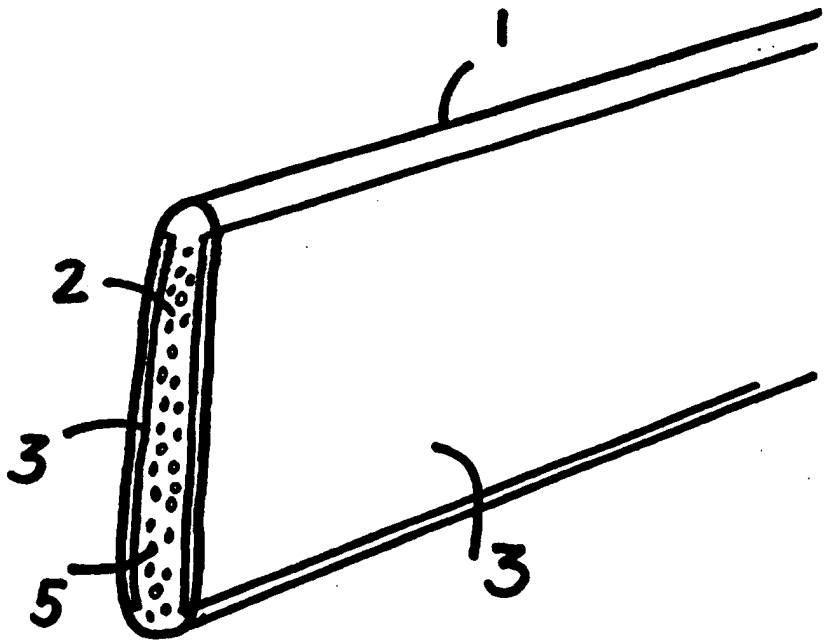
(54) Title: METHOD OF MANUFACTURING A BLADE

(57) Abstract

A method of manufacturing a blade which can be used in sports such as street-hockey and ice hockey, wherein the blade is manufactured in that a core material of thermoplastic is welded to a reinforcing fibre material of glass fibre.



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METHOD OF MANUFACTURING A BLADE

The invention relates to a method for manufacturing a blade, in particular a blade which can be used in sports such as street-hockey, ice hockey, bandy and indoor bandy.

Traditionally the blades and shafts of hockey sticks are made of a wood material which is often reinforced with glass fibre or other plastic material. As a rule, the blade of the stick is composed of several thin sheets of laminated wood to give improved properties. These wood materials are often enveloped by a woven glass cloth glued in place. Polyester or epoxy is applied onto the cloth in a so-called wet lamination. Usually, the blade and the shaft constitute one unit and are manufactured in an integrated production process. In the present method the blade is manufactured separately in order subsequently to be attached to a shaft.

A disadvantage of the traditional methods of manufacturing blades and/or shafts is that they are manually demanding, produce products of variable quality, and the production process is not very environment-friendly.

The blade of the invention is built up of a core material (web material) consisting of a thermoplastic. This core material is welded or cast together with a long-fibred reinforcing material which also has a binding agent (matrix) of thermoplastic having a melting point adapted to the core material (web material). In this way, very good bonding will be obtained between the core and the reinforcing material when joining by fusion, in that a virtual welding takes place. The blade which is made in the present invention will be a homogeneous unit, where the core material and the reinforcing material are welded together.

Today's ice hockey sticks often get delamination spots on the blade when , e.g., a puck, skate or something else strikes the blade. These spots, which involve weakened properties, produce white marks on the surface of the blade, and are often called white spot. These white marks are a result of the applied woven glass cloth becoming detached from the underlying wood material. When exposed to great stress, there will be so much white spot that the blade will gradually become fatigued and weakened. This leads to a reduction in the stiffness of the blade and the blade becoming more springy. Over time the blade will become weakened to such an extent that it will eventually break.

The blade in the invention may preferably be manufactured with a female or male connection so that the blade can be attached to a shaft having a complementary connection. By manufacturing the blade separately, it is sufficient for a player to change only the blade, i.e., the part of the stick most exposed to wear and tear. In this way, it becomes unnecessary to throw away the whole stick.

Alternatively, it is possible to produce the blade and shaft as a single unit, i.e., without the connection possibilities.

By making a specific choice of materials and using the method of manufacture in the invention, a blade can be obtained made of a thermoplastic material having a long-fibred structure, which is highly wear-resistant.
The blade is very impact-resistant and stiff, and thermoplastic material is wear-resistant and provides desired friction. The blade is highly homogeneous and the formation of white spot on the surface will not be encountered. The blade will maintain its properties and not be weakened during use.

The blade manufactured according to the invention will have improved qualities relative to conventional blades. In conventional blades made of wood laminates, there is a certain dependence upon the choice of wood and the gluing together to bring out special properties. With the method according to the invention the properties of the blade, such as twist, bend, stiffness and curvature, can be determined in detail. The blade in the invention is also low in weight and, if so desired, of a stiffness different from that of a conventional wood/glass fibre blade. The blade in the invention is preferably manufactured so that it can be attached to and detached from a stick shaft, but it is also conceivable that both blade and shaft are cast as one unit.

With the method of the invention, a blade is obtained having adjustable surface geometry. The blade, which is fully synthetic, will not absorb moisture and water, in contrast to blades made of wood materials. The whole blade has the same properties throughout. It is impossible to separate the core material from the reinforcing material that is welded together therewith.

The invention will be explained in more detail below with the aid of the figures wherein:

Figure 1 is a side view of a blade;

Figure 2 illustrates a cut-through blade.

The blade 1 is manufactured in that a blade core material 2 is injection moulded in a tool suitable for the purpose. The blade core consists of a thermoplastic material, e.g., polypropylene. A gas which forms small pores 5 when the blade hardens may be added to the thermoplastic material. As shown in Fig. 2, most of the pores are formed in the centre of the core material, with a form of integral skimming effect towards the surfaces. These pores 5 ensure that the blade is lighter and stronger. A reinforcing fibre material 3 is applied by heat on each side of said core material 2. This reinforcing material consists of long fibres, e.g., glass fibre with a thermoplastic which are welded together and form a laminate. The fibres may be so long that they extend over the entire length of the blade. Several fibre layers which have been mounted together in advance are usually used. The fibres are then mounted together so that the angles between the fibre filaments are different. It is, e.g., conceivable that a main direction of a fibre layer is parallel to the blade, whilst a second fibre layer forms an angle of 45° with the first layer. If four fibre layers are used they can be laid on top of one another at the following angles relative to one another: 0, 45, 0, 45 or 0, 22, 0, 22.
The invention is not restricted to these angles between the fibre layers. The angle of the fibres is also chosen in relation to the shaft angle so that optimal properties are obtained in the blade. Usually, four layers of glass fibre are used which have been pre-welded together into one unit, which may have a thickness of 0.2 cm.

The blade may be manufactured with a male or female connection 4 for mounting onto a stick shaft 7. Commonly, the blade 1 has female part 4 which fits with a corresponding shaft connection and is secured by means of a milled groove, and both parts are pressed, welded or glued together.

Glass fibre laminates which normally consist of fibres forming angles with one another, are punched out in advance in the approximate shape of a blade. The pre-punched out laminates consisting of thermoplastic and glass fibre or optionally carbon fibre are laid in place against the outer face of a moulding tool suitable for the purpose. The core material of, e.g., melted polypropylene, is poured into the space between the two previously inserted laminates. At the same time the matrix material is melted with the aid of a heat source. The whole process takes place with the aid of the supplied heat which is sufficient to ensure a safe and good joining of the core matrix and the fibre material.

In this way the fusion of the laminate and the core material into a robust and welded piece is obtained, so that the blade is a homogeneous unit. It is not possible to see transitions or seams between what was core material and reinforcing material.

The blades in the method of the invention initially are made having the same blade curvature and blade geometry. If there is a desire for a different blade geometry, this is effected in that heat is supplied to one of the sides of the finished blade. The heating can take place at 160°C to 180°C for 15 to 20 seconds. The supplied thermal quantity must be sufficient to "loosen" the outer fibre material 3 from the core 2. During bending in a bending tool, the fibre material will slide on the core material and reattach itself to the core when the desired bend has been obtained. This takes place in the binding agent melts under the effects of heat so that the fibres can slide along the also heated core surface. When the blade is bent to the desired shape and geometry, everything is frozen in that the blade is cooled to room temperature, or at least to below vicat softening point.

Conceivably, the method may also be implemented in that the blade is pre-cast, whereupon the laminate and blade are heated so that the surface of the core material and the laminates fuse together.

The blade manufactured in the method of the invention can be endowed with quite specific properties depending upon the choice of materials.

The blade of the invention does not incur the characteristic white marks, white spot, after spot loading which, e.g., may happen when a conventional wooden blade is struck by a hard puck impact or similar. The properties of the blade such as friction on the surface can be altered by adding block polymers with a filler of a rubber elastic thermoplastic material having approximately the same melting point as other parts of the blade.

By choosing a suitable tool the twist and bend of the blade (e.g., hook, open and closed) can be varied easily. In this way each blade can be made having specific properties, and can be "tailor-made" according to a player's wishes. Other properties which can be altered according to desire are the stiffness and springing of the blade.

Patent claims

1.

A method of manufacturing a blade which can be used in sports such as street-hockey, ice hockey, bandy and the like, characterised in that a core material (2) is joined to a fibre material (3) at a temperature which is above the melting point of the materials.

2.

The method of claim 1, characterised in that the core material (2) consisting of a heated thermoplastic in introduced into a tool, whereupon the fibre reinforcing material consisting of glass fibre and a thermoplastic are welded to the core.

3.

The method of Claims 1 and 2, characterised in that the reinforcing material is glass fibre consisting of long fibres together with a thermoplastic.

4.

The method of Claims 1 to 3, characterised in that the fibres are from 5 to 50 cm in length.

5.

The method of Claims 1 to 4, characterised in that the reinforcing material (3) consists of several glass fibre layers which are pre-welded together in such a way that the glass fibre filaments form an angle with one another.

6.

The method of Claim 1, characterised in that the joining of the core material with the reinforcing material takes place at a temperature of from 150° C to 300°C, preferably from 170°C to 250°C.

7.

A blade, characterised in that it consists of a thermoplastic core material which is joined to long glass fibres.

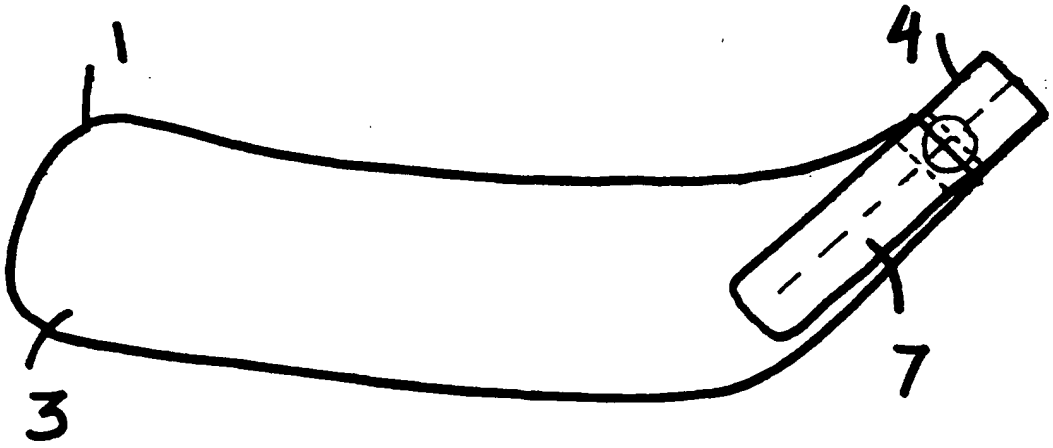

Fig.1

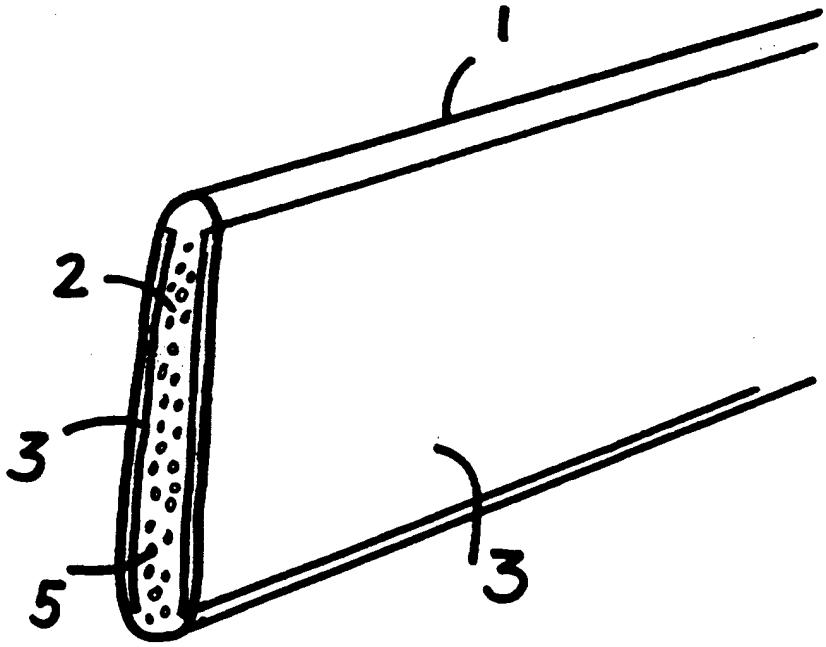

Fig.2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO 97/00066

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: A63B 59/12
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: A63B, B29C, B29D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT *

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